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Abstract

Aims: Although the general public appears to have embraced the term 'video game addiction', the scientific debate as to whether 'gaming addiction' can actually be considered an addiction similar to substance addictions of DSM-IV is still unsettled. To date, research on gaming addiction has focused on problematic behavior from the gaming activity itself and there has been little empirical research related to pathological personality patterns that usually are associated with substance addictions. Therefore, the current study examined how excessive gaming and 'problematic gaming behavior' are related to personality patterns associated with addiction by means of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2). **Design, setting, and participants:** A large-scale survey study among 1,004 adolescent boys (age-range 11-18 years; M = 14.18, SD = 1.36; response rate 96.17%). **Measurements:** Problematic gaming behavior, physical game-related symptoms, gaming behavior and three MMPI-2 subscales measuring personality patterns usually associated with substance addiction (MAC-R, APS, AAS) were assessed. **Findings:** Results showed that problematic gaming and physical game-related symptoms were positively related to all three substance abuse subscales of the MMPI-2. **Conclusions:** Problematic gaming should be clearly distinguished from excessive gaming. In short, excessive gaming merely indicates enthusiasm for some although it may be psychopathological for others.

Keywords: excessive gaming, video game addiction, pathological gaming, adolescents, MMPI-2, substance abuse

In his recent book *'Unplugged: My Journey into the Dark World of Video Game Addiction',* former video game addict and university professor Ryan van Cleave describes how he almost lost everything as his life became consumed by online gaming. On the verge of committing suicide he attempted to break his deleterious habits, only to find himself with heavy withdrawal symptoms as a drug addict trying to wean off from drugs. The story of Van Cleave, who was born as Ryan G. Anderson but changed his name in tribute to his *World of Warcraft* arena team, is one of many that is frequently cited by the media.

While the mass media and the general public seem to have accepted terms like 'video game addict' and 'gaming addict' referring to individuals who play video games excessively, the scientific world is still debating definitions and parameters of 'gaming addiction'. One question is the extent to which excessive gaming can be considered a healthy enthusiasm, or whether it is indicative of an addictive mental disorder. The media may be right, but empirical evidences is still lacking. The present study aims to provide such empirical evidence. It examines whether excessive gaming can be indicative of a psychiatric disorder similar to those described in the *Diagnostic and Statistical Manual of Mental Disorders* [DSM-IV-TR,1] or similar to the mental and behavioral disorders in the *International Classification of Diseases* [ICD-10,2]. The study examines how current practices in defining and measuring 'gaming addiction' relate to clinical personality assessment methods associated with substance dependence. Mental disorders and game addiction are discussed and tested in the framework of the Minnesota Multiphasic Personality Inventory-2 (MMPI-2).

Research shows that adolescent boys spend increasing amounts of time playing video games [over one hour a day on average and up to 13 hours per week,3-4]. Video games appear to be especially attractive to boys[5-6] although this may be because most video games are designed by males for other males[7]. Studies have shown that gaming may positively

affect physical wellbeing as well as social aspects of life[5,8]. Reviews of video game playing have also reported detrimental effects for players who appear to play excessively[6,9]. The topic that arguably generates the most comments, critique and debate is that of *gaming addiction*. Consequently, scholars in the field started using different terms, such as pathological gaming, video game addiction, video game dependence, and problematic game playing[10,11], which further complicates the debate.

The debate highlights the importance of clearly distinguishing between the motivations of excessive enthusiastic gaming and excessive addictive gaming[9,10,12,13]. Excessive gaming may not be problematic for all gamers, whereas addiction is always detrimental for the player involved[9,12]: "Healthy excessive enthusiasms add to life, whereas addictions take away from it"[p.247,10]. Thus, problems and negative consequences experienced due to excessive gaming appear to distinguish healthy excess from unhealthy excess. Others argue that experiencing problems from excessive gaming is not enough to diagnose the gaming behavior as an addiction[15,16]. A longitudinal study showed that short-term excessive and problematic behavior is not usually addictive[17]. The study found that gamers defined as pathological remained at pathological levels for years.

Griffiths[18,19] argues that there are six psychological components to any addiction, which when applied to gaming are: 1) salience (i.e., gaming dominates thoughts, feelings and behavior); 2) mood modification (i.e., gaming is used as a coping strategy, to change mood); 3) tolerance (i.e., needing to play games longer to achieve similar levels of mood modification); 4) withdrawal symptoms (i.e., feeling psychologically or physically unpleasant when unable to play); 5) conflict (i.e., inter- and/or intrapersonal conflict caused by the gaming behavior); and 6) relapse (i.e., falling back to old game play patterns after a period of abstinence). These six components largely coincide with the criteria for substance dependence in both the DSM-IV-TR and the ICD-10[2].

A not unrelated issue in the debate concerns the question whether addiction is a primary or secondary problem. For instance, Wood[21] recognizes that some gamers play excessively and consequently experience problems, but argues that the gaming behavior itself may not be the cause of the problems, but rather a symptom of other pre-existing problems, such as bullying or trouble with emotion regulation. Griffiths[22] contests this view. He argues that for many alcoholics and drug addicts their behavior also is symptomatic of other underlying problems that existed prior to the addiction, which is known as secondary addiction in the addiction literature. Despite the difference between primary and secondary addictions, the resulting behavior is nonetheless addiction[22].

The discussion about gaming addiction is part of a wider debate on the comparison between traditional chemical addictions (such as those involving alcohol, nicotine, and other drugs) and behavioral addictions that do not involve the ingestion of a psychoactive substance (such as gambling, gaming, sex, and exercise). Currently, both the DSM-IV-TR[1] and the ICD-10[2] have enlisted substance dependence and substance abuse (or harmful use) under the category of substance use disorders. However, these terms are limited to addictions involving substances. Many academics argue that other (non-chemical) behaviors may also be addictive[10,18,23,24], and these kinds of behavioral addictions have therefore often been referred to as non-chemical (behavioral) addictions.

This ongoing debate on defining addiction highlights the need for a empirical evidence demonstrating whether excessive gaming can be addictive in a similar way as substance addiction. Recent (fMRI) studies have shown that similar neural processes take place in both substance addicts and online gaming addicts, and the experiences of both groups appear very similar[9]. Moreover, increased activity was recorded in the brain of game addicts in areas that are usually associated with substance addictions. However, to provide a definitive answer to the question, scholars suggest that the behavioral ‘addicts’ need to be compared to known

and established clinical criteria for substance addictions[10,14,18]. The current study adds to this by examining whether ‘game addicts’ display similar pathological personality structures to substance addicts.

The Minnesota Multiphasic Personality Inventory-2 (MMPI-2) is the most widely used clinical screening instrument for assessing psychopathology and maladaptive personalities[34-36]. The full MMPI-2 consists of 567 items, based on a so-called criterion keying method. This personality inventory is widely acknowledged and has the advantage over earlier personality inventories because it is less sensitive to socially desirable answering patterns and less dependent on face validity[37]. From the MMPI-2 item pool, a number of subscales have been derived with limited numbers of items among which subscales that discriminate between substance abusers and non-abusers as well as between substance abusers and those suffering from other mental disorders. Three subscales specifically tap into personality patterns associated with substance abuse[34].

The oldest subscale is the MacAndrew Alcoholism Scale - Revised [MAC-R,38]. Even though MacAndrew originally created the scale to detect alcoholism, there is substantial evidence that drug abusers and pathological gamblers are in the same range as alcoholics on the MAC-R. MAC-R is also referred to as a measure of addiction proneness or increased risk of substance abuse rather than a substance abuse detection scale[34,37]. One of the strengths of the MAC-R is that items that clearly related to substance abuse were excluded. Due to this low face validity, the scale is virtually insensitive to the denial of substance abuse problems[39]. Therefore, the MAC-R is appropriate for the present study as the scale offers a subtle and indirect measure of a personality pattern often associated with addiction, while being virtually resistant to denial.

A second MMPI-2 subscale used in the present study is the Addiction Potential Scale [APS,40], which was designed to identify “personality characteristics and lifestyle patterns

that are associated with alcohol and drug abuse"[pp.390-391,40]. In line with the development of the MAC-R, items that obviously referred to substance abuse were excluded from the APS[37,39,40]. The APS differs from the MAC-R in that the first assesses risk of substance abuse on the basis of general psychological distress, while the latter assesses that risk on the basis of antisocial and impulsive personality patterns[34].

To complement the MAC-R and APS, the Addiction Acknowledgment Scale [AAS,40] was included. In contrast to the two scales described above, the AAS was specifically intended to tap into the willingness to admit substance abuse. Comparisons of the different substance abuse scales have quite consistently shown that the AAS outperforms both the MAC-R and the APS in discerning between substance abusers and non-abusers[34,35,41].

Thus, well-established measures to assess maladaptive personality patterns associated with substance abuse were related to measures of excessive and problematic gaming behavior to address the extent to which excessive gaming can be conceptualized as an addiction. Given the prevalence and popularity of playing video games among adolescent boys, the current study was limited to adolescent boys as the most appropriate target sample for further investigation.

Method

Participants and Design

A survey study among 1,004 adolescent boys (age–range 11-18 years; *M*=14.18, *SD*=1.36; response rate 96.17%) was conducted, sampling 14 different secondary schools located in both rural and urban areas. Educational (IQ) ability levels varied and the large majority of participants had a Caucasian background. Most boys reported playing games (97.41%), while a minority (2.59%) indicated they never played video games.

Procedure

The study was conducted at schools. Consent for study participation was retrieved from school authorities, teachers, and parents. Only one parent refused their child's participation. Upon entering a classroom, participants were asked to answer the questions privately. Anonymity and confidentiality of answers were ensured. Participants could withdraw from the study at any time. Completing the questionnaire took 20-30 minutes. Finally, participants were debriefed and thanked.

Measures

All measures comprised multiple statements with dichotomous answering options to indicate to which extent each item fitted the participant ('yes'/'no'). In line with common practices in applying the MMPI-2, and for purposes of analysis, all 'no' answers were scored '0' and all 'yes' answers were scored '1'. The MMPI-2 is a highly standardized personality inventory that is generally used by therapists for assessing psychopathology in clinical practice using such a scoring and scaling profile method[34,35,40].

Problematic gaming behavior was measured by six of the items from Griffiths' checklist[19,43], that largely overlaps the six psychological components of addictions presented by Griffiths[18]. Items were simplified for the adolescent boys (e.g., "I often play 3 to 4 hours on end when I play a game"). Summing item scores created a scale-score (range 0-6), with higher scores indicating higher levels of game-related behavioral problems.

Physical game-related symptoms were measured by simplifying the seven physical symptoms presented by Griffiths[10,19]. The word 'game' itself was not mentioned in any of these items (e.g., "I often have back aches"; "I regularly skip meals"). Summing scores formed a scale-variable (range 0-7). Almost half of the participants indicated not experiencing any of the physical complaints, resulting in a relatively low mean (M=1.12, SD=1.28).

The MacAndrew Alcoholism Scale-Revised [MAC-R,38] was included as an indirect measure of addiction proneness, consisting of 49 items. Given our target group, two items

were simplified (e.g., “I have had problems with the police or a judge”; “I sometimes get the feeling that I leave my body and can see myself”). After reverse-coding, 11 items, scores were summed. Participants’ actual scores ranged from 8 to 34 (*M*=19.88; *SD*=4.11).

The Addiction Potential Scale [APS,40] was included in the study as a complementary scale to the MAC-R, as it assesses general risk for addiction via a different personality pathway[34]. The APS comprises 39 items (e.g., “Sometimes, my mind seems to work slower than usual”; “Most people are honest, mainly because they are scared to get caught”). After reverse-coding 16 items, scores were summed (range 10-30; *M*=20.45; *SD*=3.54).

The Addiction Acknowledgement Scale [AAS,40] was included as an obvious and face valid measure of the respondent’s willingness to admit addiction. Of the 13 items of the original scale, nine pertained specifically to drugs or alcohol, and thus the words alcohol and drugs were replaced by ‘gaming’ (e.g., “Only when I play a game, I can really be myself”; “After a bad day, I usually need to play a game to relax”). After reverse-coding, three items, scores were summed (range 0-11; *M*=4.39; *SD*=2.18).

Game exposure was measured by asking participants how many hours per week they played video games. Game exposure ranged from 0.5 hours to 76 hours a week (*M*=10.56, *SD*=10.31), which is in the same range as findings reported in other studies[7,42].

Preferred gaming mode was measured by asking respondents whether they preferred to play games offline or online.

Finally, several *demographics* questions were included (e.g., age, education).

Results

Problematic gaming status was established on the basis of Griffiths’ guidelines[19,43] that answering ‘yes’ to more than four items of the problematic gaming behavior scale indicated problematic gaming behavior (such a cut-off score is only available for Griffiths’

scale and the MAC-R). In the current study, this resulted in 86 boys (8.57%) being classified as problematic gamers, with the remaining 918 boys (91.43%) being classified as non-problematic gamers. Regarding the MAC-R, MacAndrew suggested a cut-off score of 24 items answered with 'yes'. That is, participants with a MAC-R score higher than 24 are more likely to have an addictive personality than others[37]. Based on this cut-off score, in the current study, 14.14% adolescent boys showed a MAC-R score indicating an addictive personality, while the remaining 85.86% of the total sample was not. Thus, the MAC-R score revealed a larger group of 'game addicts' than Griffiths' problematic behavior scale.

Next, the relationships between the different scales were analyzed, following the guidelines provided by Cohen[44]: *r*'s between .10 and .30 were considered small effects, *r*'s between .30 and .50 were considered medium effects, and *r*'s larger than .50 were considered large effects. The correlation matrix (Table 1) showed that all correlations were positive and significant at the .01-level. Problematic gaming behavior was found to correlate strongly with the Addiction Acknowledgment Scale (AAS). Small correlations were found between problematic gaming behavior and the more indirect measures of addictive personality, the MAC-R and APS. Small correlations were also found for physical symptoms and all three MMPI-2 subscales.

The next analysis related game exposure and preferred gaming mode to each of the scales (Table 2). Results showed that game exposure correlated moderately with problematic gaming behavior and the AAS, while it did not significantly correlate with the two indirect measures of addictive personality (MAC-R and APS). For preferred gaming mode, moderate correlations were found with problematic gaming behavior and the AAS. Physical game-related symptoms were found to be unrelated to game exposure and preferred gaming mode.

Next, a multivariate analysis of variance (MANOVA) was performed to check whether problematic gamers [based on the cut-off score in Griffiths,19,43] differed from non-

problematic gamers in their scores on the MAC-R, APS, and AAS. Multivariate tests revealed a significant main effect, Wilk's λ=.87, $F(3,1000)=50.67$, $p<.001$, $\eta_p^2=.13$. Univariate *F*-tests (Table 3) showed that the boys who were classified as problematic gamers scored significantly higher on all three scales than non-problematic gamers.

Finally, a check was made as to whether these differences would remain when other variables were controlled for, including game exposure, preferred gaming mode, and age. Therefore, a multivariate analysis of covariance (MANCOVA) was performed with the same variables, this time including the above mentioned control variables as covariates[1]. Multivariate tests showed significant effects for all three covariates, while the multivariate effect for problematic gaming behavior remained intact (Table 4).

Univariate *F*-tests further supported that the main effects of problematic gaming behavior remained intact when game exposure, preferred gaming mode, and age were controlled for (see Table 5). Boys classified as problematic gamers were found to have significantly higher scores than the other boys on the MAC-R, APS, and AAS, even when controlling for their game exposure, preferred gaming mode, and age. With regard to the covariates, the univariate *F*-tests (Table 6) showed that game exposure and preferred gaming mode significantly affected MAC-R and AAS scores, but not APS scores. In contrast to this, age did not significantly affect AAS scores, but did significantly affect APS and MAC-R scores.

Discussion

The primary aim of the current study was to examine whether excessive game play can be considered an addiction in terms of pathological behavior, or whether these are unrelated and excessive game play should just be considered high enthusiasm for playing

[1] Because the questions about preferred gaming mode and excessive gaming (reported hours of gaming per week) were not mandatory for participants who indicated that they were not gamers, the *N* in the MANCOVA is lower than the *N* reported in earlier analyses, resulting in slightly different degrees of freedom and means.

games. Therefore, a large scale survey among adolescents boys was performed in which problematic gaming behavior and game exposure were related to three well-established MMPI-2 substance abuse subscales, namely the MacAndrew Alcoholism Scale–Revised, the Addiction Potential Scale, and the Addiction Acknowledgement Scale.

The study's findings indicate that problematic (psychological) gaming behavior and physical game-related symptoms were each positively related to the three substance abuse personality scales of the MMPI-2. This appears to indicate that problematic gaming and physical game-related symptoms are associated with personality patterns also found in substance addicts. Furthermore, the relatively weak relationship between game exposure and physical game-related symptoms, and the somewhat stronger relationship between these symptoms and problematic behavior from gaming, appear to suggest that physical symptoms are not necessarily related to playing for many hours on end. Rather, the physical game-related symptoms appear to be related to the psychological issues these boys experience from their problematic gaming behavior.

Furthermore, results showed that game exposure was related to problematic gaming behavior as well as to the Addiction Acknowledgement Scale, but it was not related to the two indirect measures of addictive personality patterns (i.e., MAC-R and APS). Thus, the boys who displayed problematic gaming behavior usually played more excessively than those who do not display such behavior. This supports the line of reasoning brought forth by Griffiths[14] that excessive gaming does not always equate to problematic and/or addictive gaming. Accordingly, the lack of a relationship between game exposure and the MAC-R and the APS indicates that playing in excess is *not* related to personality patterns usually associated with addiction. Thus, excessive gaming and problematic gaming are clearly distinct concepts.

Is the media right? Well, there is something like pathological gaming addiction. But it is not the excessive gaming that is the only cause for concern. The present study showed that this relationship with personality patterns as found in addicts (i.e., a real cause for worry) was only found for those with problematic gaming behavior. Thus, the current study supports Wood's argument that excessive gaming alone "does not constitute ground for labeling the behavior an addiction"[21,p.171].

The current study's findings suggest that gaming may indeed be addictive in a similar sense as alcohol and other drugs, thereby supporting Griffiths' viewpoint that activities other than taking a substance may also be addictive[18]. Furthermore, the current study adds to the existing commonalities and similarities between substance use disorders and pathological activities, such as *gambling*[25,26] and *gaming*[9]. As the number of similarities between chemical and non-chemical addictions expands, it becomes more likely that there is indeed one psychological process underlying various, if not all, addictions; chemical as well as non-chemical[9,16,21]. Thus, video gaming is not inherently addictive but may be expressed as pathological gaming in personalities sensitive to addiction.

Our findings show that the percentage of gamers suffering from personality patterns related to addiction is 14.14% based on problematic MAC-R-levels and 8.57% based on problematic behavior from gaming. These percentages are in the same range as prevalence estimates for pathological gaming in related studies[11-12,17,27,45] and other chemical and non-chemical addictions[28].

However, the study's survey design cannot establish causality. As with previous studies in this line of research, the direction of the relationships between excessive gaming and other variables were not established. Future research may apply longitudinal designs to study causal patterns in problematic gaming behavior. The few longitudinal studies available

on gaming addiction have not focused on using personality inventories such as the MMPI-2 for assessing addiction-related personality patterns.

Currently, the DSM-IV-TR[1] and the ICD-10[2] do not include criteria for pathological gaming or gaming addiction, nor does the proposed revised DSM-V[46]. In the DSM-IV-TR, pathological *gambling* was clearly separated from chemical addictions, as it was initially categorized under 'impulse control disorders' and later categorized under 'substance use disorders'. For the envisioned DSM-V, the APA has proposed to rename the category 'substance use disorders' to 'substance use and addictive disorders', thereby opening up the possibility to include both chemical as well as non-chemical addictions and move pathological *gambling* to this new category[46]. In considering internet addiction (including online gaming) for inclusion in this new category, APA concluded in 2010 that present empirical evidence was not sufficient to warrant inclusion[47]. The findings presented in this paper as well as recent empirical studies[17] warrant a reconsideration of including pathological gaming in the DSM-V.

Even though many questions still remain about the nature of non-chemical (behavioral) addictions, the current study suggests that behavioral addictions may originate from similar psychological processes as substance addictions[24]. It is valuable putting more effort into understanding this process instead of debating its existence. In sum, the present study showed that gaming addiction goes beyond excessive gaming and some gamers may display personality patterns that are usually associated with substance addiction. Thus, while some game players can indeed be diagnosed addicted in terms of pathological behavior, researchers need to be careful in *whom* are classified as addicted.

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Table 1. Correlations between problematic gaming behavior (PGB), physical game-related symptoms (PGS), the MacAndrew Alcoholism Scale - revised (MAC-R), the Addiction Potential Scale (APS), and the Addiction Acknowledgment Scale (AAS).

	PGB	PGS	MAC-R	APS	AAS
PGB	-				
PGS	.15*	-			
MAC-R	.12*	.27*	-		
APS	.17*	.29*	.52*	-	
AAS	.65*	.27*	.30*	.25*	-

* $p < .01$

Table 2. Correlations between game exposure (GE), preferred gaming mode (PGM), problematic gaming behavior (PGB), physical game-related symptoms (PGS), the MacAndrew Alcoholism Scale - revised (MAC-R), the Addiction Potential Scale (APS), and the Addiction Acknowledgment Scale (AAS).

	GE	PGM †
PGB	.50**	.24**
PGS	.07*	.06
MAC-R	-.02	.08*
APS	-.01	.05
AAS	.39**	.23**

* $p < .05$ ** $p < .01$
† Preference for playing offline or online, coded as offline = 0, online = 1

Table 3. Means and standard deviations for the univariate main effects of problematic gamer status on the MacAndrew Alcoholism Scale – Revised (MAC-R), the Addiction Potential Scale (APS), and the Addiction Acknowledgment Scale (AAS).

	Problematic gamers		Non-problematic gamers				
	M	*SD*	*M*	*SD*	*F**	*p*	η_p^2
MAC-R	21.47	4.47	19.74	4.04	14.13	<.001	.01
APS	21.52	3.20	20.35	3.55	8.68	<.01	.01
AAS	6.98	2.08	4.15	2.03	152.20	<.001	.13

* Degrees of freedom for all factors are (1,1002)

Table 4. Multivariate effects for problematic gaming behavior and the covariates game exposure, preferred gaming mode, and age.

	Wilk's λ	*F**	*p*	η_p^2
Problematic gaming behavior	.93	22.30	<.001	.07
Game exposure	.89	37.80	<.001	.11
Preferred gaming mode	.98	6.61	<.001	.02
Age	.98	7.55	<.001	.03

* Degrees of freedom for all factors are (3,883)

Table 5. Means and standard deviations for the univariate effects of problematic gaming behavior on the MacAndrew Alcoholism Scale – Revised (MAC-R), the Addiction Potential Scale (APS), and the Addiction Acknowledgment Scale (AAS) when controlling for game exposure, preferred gaming mode, and age.

	Problematic gamers		Non-problematic gamers				
	M	*SD*	*M*	*SD*	*F**	*p*	η_p^2
MAC-R	21.33	4.51	19.73	3.90	17.80	<.001	.02
APS	21.54	3.24	20.30	3.47	11.86	<.01	.01
AAS	7.07	2.07	4.28	2.02	63.06	<.001	.07

* Degrees of freedom for all factors are (1,885)

Table 6. Univariate effects of the covariates game exposure, preferred gaming mode and age on the MacAndrew Alcoholism Scale – Revised (MAC-R), the Addiction Potential Scale (APS), and the Addiction Acknowledgment Scale (AAS).

		F*	p	η_p^2
Game exposure	MAC-R	8.86	.003	.01
	APS	2.13	.15	<.01
	AAS	76.20	<.001	.08
Preferred gaming mode	MAC-R	8.68	.003	.01
	APS	2.23	.14	<.01
	AAS	16.66	<.001	.02
Age	MAC-R	9.82	.002	.01
	APS	19.56	<.001	.02
	AAS	<1	.93	<.01

* Degrees of freedom for all factors are (1,885)